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ABSTRACT

To meet the challenges of preparing teachers for the information-based society, the University of Houston-Clear Lake (Texas) in collaboration with the Houston schools, IBM, and NASA, developed the Teacher Education Advancing Academic Achievement Model (TEA3M). This paper addresses the integration of technology and innovative instructional practices in the preservice and staff development training of teachers and administrators, focusing on the university's teacher education program. The collaborative is in its first year of development, with goals of analyzing computer technology requirements at each collaborating site, installing the necessary equipment and software, defining a curriculum, and beginning the design and delivery of instruction. By the first summer, the local area networks, collaborative-wide network, and Teacher Technology Exploration Center should be fully operative. Five figures illustrate the discussion. (Contains 10 references.) (SLD)

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Title:

TEA^{3}M: A System for Infusing Technology into Teacher Education

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TEA^{3}M:
A System for Infusing Technology into Teacher Education

To meet the challenges of the 21st century, teachers must address the highly diverse needs of today's students and prepare them for life in an information-based, technology-driven society. To respond to these challenges, the University of Houston--Clear Lake, in collaboration with Houston area school districts and communities, NASA, and IBM have established the Teacher Education Advancing Academic Achievement Model (TEA^{3}M) to design and implement an innovative program for teacher education. This paper addresses the integration of technology and innovative instructional practices in the pre-service and staff development training of teachers and administrators. More specifically, this paper describe the systems approach taken to restructure and infuse technology into the pre-service and in-service teacher education program at the University of Houston--Clear Lake

Systems Approach to Infusing Computer-Technology

The high-tech transformation of schools predicted by many has yet to materialize. Schools today look very much like they did a hundred years ago. Compared to our counterparts in business and industry, relatively little has changed in practice or structure. In few instances, one may find a class where students' huddle around computer workstations, actively engaged in group problem-solving, working as a team to access, manipulate, and interpret vast amounts of information as an integral part of their schooling. More common is the sight of students, herded through computer-labs to learn isolated computer-skills or to remediate instruction. Effective and innovative applications of computer-technology with classroom instruction remain isolated.

A number of factors contribute to the inadequate use of computer-technology. Insufficient resources, incongruence with teachers' beliefs, incompatible hardware, top down initiation, fear of change, lack of rewards, inadequate software, and insufficient time or training are some of the more well documented causes. Together, these factors suggest one basic underlying problem: failure to view education as a system, a set of interrelated components that must work together to achieve a common purpose.

Applications of the "Systems Approach" to education are not new. Human performance specialists made system concepts popular during the 1960's and 1970's. Many alternative models are now available including those of Senge (1990), Banathy (1987), Kaufman & Thiagarajan (1987), Dick & Carey; (1985), Deming (1982), Branson, Rayner,

Cox, Furman, King & Hannum (1976), Churchman (1969), and Gagne (1962). The purposes and contents of each model differ based on context and the authors' interpretation of General Systems Theory (GST). There is, however, one basic concept common to all approaches: A system is a set of interrelated components that work together to achieve a common purpose. The reminder of this paper describes how this principle is being used to create a system for infusing computer-technology with teacher education.

Defining System Goals

Application of the systems approach began with goal definition. By first defining their goal, system designers were able to identify essential system elements and focus their resources without the constraints of existing organizational policies or structures. To help ensure that the goals for technology would be aligned with other system components, a collaborative mission definition process was used with participation from all system stakeholders (more information about the mission definition process is given later in this paper).

The goal for technology was defined as, "to ensure that all prospective and practicing educators are technology proficient. That is, they will be able to facilitate student and their own performance using: (1) personal productivity tools (e.g., word processors, databases, spreadsheets, and graphic programs); telecommunication tools (e.g., E-mail, electronic networks, and on-line services); learning tools (e.g., drill & practice, tutorials, simulations, multimedia programs); learning management tools (e.g., gradebooks, test banks, electronic portfolio's); (5) programming and authoring tools (e.g., HyperCard, Macromind Director, Linkway, Asymetics Toolbook, Basic, LOGO, Pascal), and 6) collaborative tools (e.g., electronic group problem-solving, decision-making, and brainstorming applications)." It was argued that attainment of this goal was essential for the collaborative to achieve its mission.

The second step in designing the system was to define the interrelated components that must work together to achieve its goal. Figure 1 illustrates the essential functional components of the system. This model is based on the operations model for successful schooling developed by Florida's Schoolyear 2000 initiative (Branson & Hirumi, 1994).

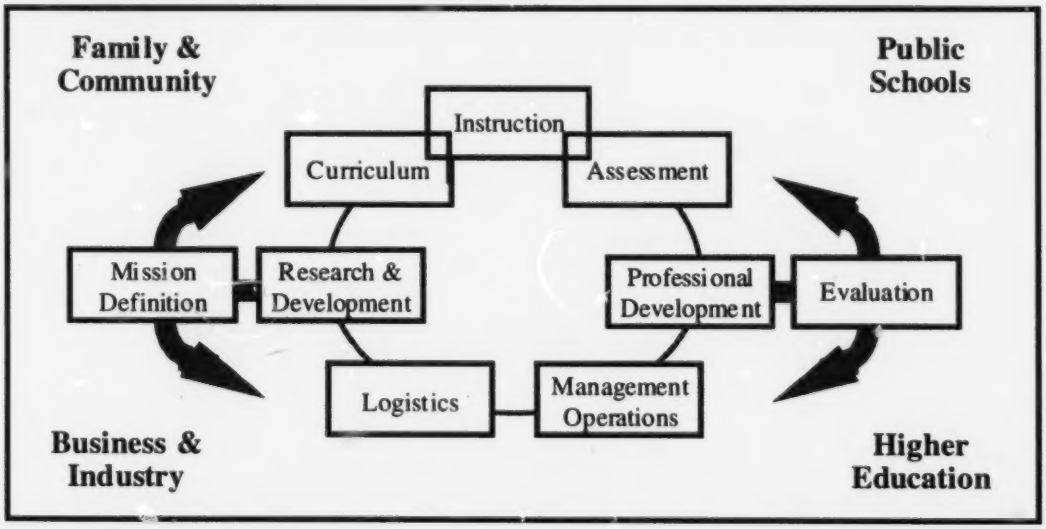

Figure 1. TEA^{3}M's System for Infusing Computer-Technology

System Components

The system for infusing computer-technology under development by the TEA^{3}M collaborative is made up of nine interrelated components. It is believed that these nine components must be designed to work together in order to develop an effective and efficient system for infusing computer technology with teacher education. This system is also viewed as a subsystem of the larger teacher education system and thus, must be designed to work with other components of teacher education. The remainder of this section describes the function and design of each system component.

Mission Definition

The function of mission definition is to: (1) define the vision and mission for the system; (2) define functional goals for system components; (3) help define individual objectives; and (4) ensure that the objectives, goals, mission, and vision are aligned (viz. the achievement of individual objectives will result in the achievement of functional goals that, in turn, results in the achievement of the organizational mission, and achievement of the organizational mission contributes to the realization of the vision for an ideal society).

The mission definition process for the TEA^{3}M collaborative was undertaken during the planning stages of the new program. Representatives from all system stakeholders (i.e., family and community, public schools, business and industry, and higher education) spent an entire day at UHCL to define the vision, mission, and functional goals for the collaborative. The group stated, restated, discussed, and argued until consensus was reached on a vision and mission for the collaborative. Subcommittee were then formed to define functional goals for each component of the TEA^{3}M collaborative. Figure 3 depicts the vision and mission for the collaborative and the functional goal for technology.

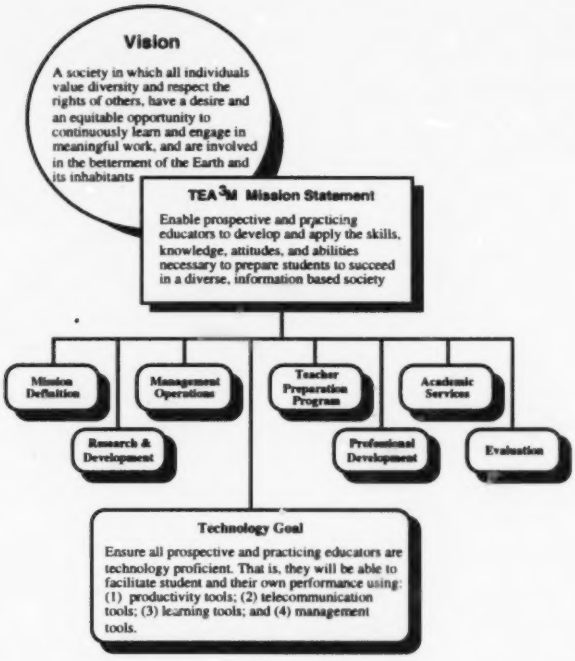
Vision
A society in which all individuals value diversity and respect the rights of others, have a desire and an equitable opportunity to continuously learn and engage in meaningful work, and are involved in the betterment of the Earth and its inhabitants
TEA3M Mission Statement
Enable prospective and practicing educators to develop and apply the skills, knowledge, attitudes, and abilities necessary to prepare students to succeed in a diverse, information based society
Mission Definition
Management Operations
Teacher Preparation Program
Academic Services
Research & Development
Professional Development
Evaluation
Technology Goal
Ensure all prospective and practicing educators are technology proficient. That is, they will be able to facilitate student and their own performance using: (1) productivity tools; (2) telecommunication tools; (3) learning tools; and (4) management tools.

Figure 3. Mission Definition for Computer Technology

Research & Development

At best, education has been slow in translating technological advances and research findings into actual classroom practices. While universities and other research institutions continue to conduct considerable research on education, technology, and learning, the results of such studies are rarely implemented at the school level. Some reasons for the lack of transfer are that research findings are not easily accessible and are not reported in a manner that is readily applicable by classroom teachers.

The function of the Research & Development is to acquire new knowledge related to educational and administrative practices, and to make this knowledge readily accessible and applicable for teachers and administrators. To help achieve these purposes, the technology component of the TEA^{3}M collaborative is developing an electronic network that will link the public schools directly to UHCL and to the Texas Education Network (TENET) and Internet. As a part of the network, a mail and file server at UHCL will contain specific areas for accessing and discussing research findings and classroom practices related to education. Professors at UHCL will locate and synthesize research related various topics (e.g., technology, early childhood education, multicultural education, interdisciplinary strategies, etc.) and make this information accessible to teachers through the server.

Curriculum

Curriculum provides guidelines for what teachers should know and be able to do with computer-technology. It also recommends curriculum scope and sequence. The words "guidelines" and "recommends" are used especially to denote the flexibility of the program. Past practices have shown that there is no one single set of competencies that are

appropriate for all teachers. Nor is it necessary for teachers to learn these many of the competencies in a specific sequence. Relevant computer competencies depend on each teachers role and responsibility and the context they are to be applied. The scope and sequence will depend, to a great extent, on each teachers' interest and prior experience.

Technology related learning outcomes for TEA^{3}M teachers are currently being specified through a collaborative-wide consensus process. The process includes several stages. The first stage was to generate a comprehensive list of computer-technology related competencies based on: (1) the predefined goal for technology; (2) a technology standard for the professional preparation of teachers specified by the collaborative; and (3) a review of national and state standards, journal articles and textbooks.

For the second stage, currently in progress, focus groups, made up of representatives from system stakeholders (e.g., teachers, administrators, district technology coordinators, university faculty) are being brought to UHCL's Group Support Systems (GSS) Lab to reach consensus on essential computer-technology related competencies. The GSS Lab is equipped with state-of-the-art electronic collaborative tools. Here, fourteen networked workstations running the software application, *VisionQuest®*, are being used to facilitate brainstorming, group discussion, and consensus building. During this activity, collaborative members are being asked to determine whether each competency is either: (1) essential to all beginning educators; (2) essential to all experienced educators; (3) essential for only certain educators; or (4) not essential.

After essential skills, knowledge, and attitudes are defined for various stakeholders, they will be grouped into logical clusters based on their content and function. The clusters will then be used to define learning outcomes. It is believed that specifying discrete skills and knowledge may inhibit learners' ability to synthesize and apply the competencies in real world situations. Thus, learning outcomes will be generated that describe how learners are expected to apply the learned competencies. The learning outcomes will then be used as a basis for instructional design and development.

Instruction

The function of instruction is to design, develop, and deliver instructional programs and materials that will enable educators to achieve the specified curricular objectives. To achieve the technology-related competencies defined by curriculum, TEA^{3}M educators will receive information, training, and support from six primary resources: (1) Knowledge Network; (2) Teacher Technology Exploration Center (TTEC); (3) Distance Learning Programs; (4) Undergraduate and Graduate Coursework; (5) Workshops and Seminars; and (6) Site-based Training and Support.

Knowledge Network

The Knowledge Network provides the backbone for transporting information to and among all system stakeholders. The network connects students, interns, public school teachers, university faculty, administrators, and business partners to each other, to the Teacher Technology Exploration Center, and to experts and databases from all over the world. The network allows the collaborative to bring expert knowledge and research on innovative educational practices and technologies directly to the public school sites as well as diffuse the knowledge acquired by the collaborative to other researchers and educators. Connection to state, national, and global networks helps free learning from the confines of the classroom, giving students and teachers virtually limitless access to knowledge and information produced by students, teachers, schools, businesses, community members, and

government agencies in Texas, the United States, and beyond. Figure 3 illustrates the design of the knowledge network.

Teacher Technology Exploration Center (TTEC)

The TTEC's primary responsibility is to train and empower students, teachers, and administrators to apply learning and performance technologies. The center will allow educators to explore leading edge technologies at their convenience. Center staff will guide them in areas of interest, expand their awareness of technology, and provide the knowledge and expertise required to utilize technology. Housed on the University campus, the TTEC will be readily accessible to teachers and administrators from over 600 schools in the 22 independent school districts surrounding the center. There will also be an on-line information service so that people can find out what is currently available at the center.

The TTEC contains six components: (1) a high-tech electronic classroom; (2) a showcase arena; (3) a multimedia development lab; (4) a resource library; (5) video production studio; and (6) research and development lab (Figure 4). The following is a brief description of each component.

Electronic Classroom. The Electronic Classroom will model a classroom of the future. It will include multi-platform, electronic workstations that will support 1-6 users that will be networked to both local and wide area networks, automated presentation stations and capabilities for synchronous and asynchronous video and audio conferencing. Graduate and undergraduate classes, workshops, seminars will be provided in the classroom.

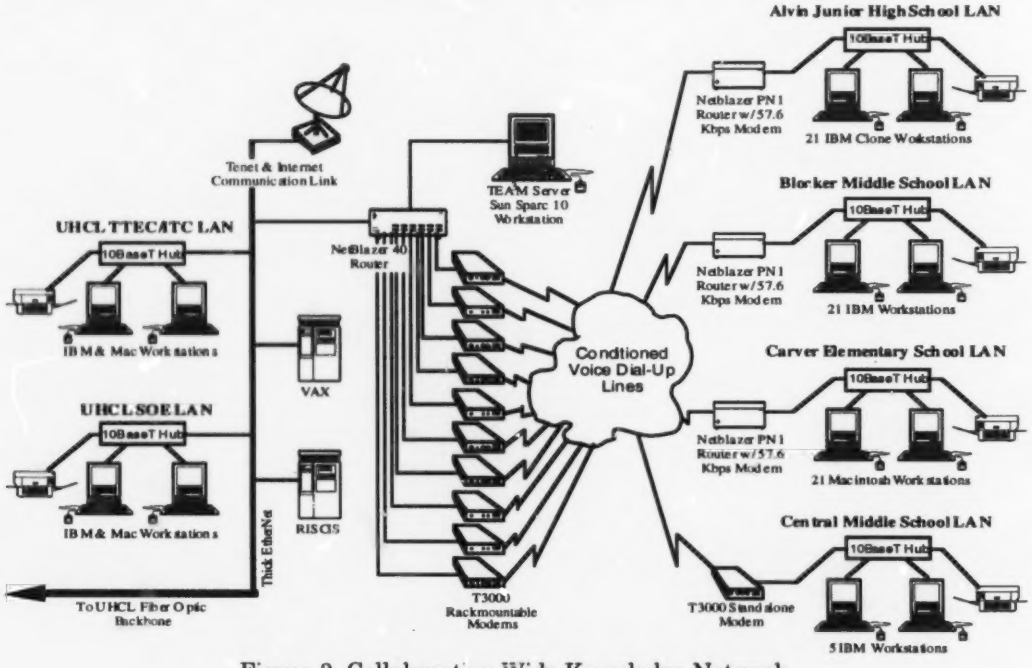

Figure 3. Collaborative-Wide Knowledge Network

Showcase Arena. The Showcase Arena features cutting-edge educational technologies. Here, teachers, students, administrators, and university faculty can explore the

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latest in educational hardware and software at their own leisure. The arena showcases a wide variety of vendor products and innovative applications developed by research institutions such as electronic performance support systems, telecommunication interfaces, electronic learning environments, instructional management software and administrative, presentation, authoring and multimedia systems.

Multimedia Development Lab. The Multimedia Development Lab will be a state of the art facility for pre-service and in-service teachers and university faculty to receive training and develop their own multi-media programs. The development area would contain multiple platforms for creating and conducting research on multimedia programs, electronic performance support tools, and innovative learning environments. It will facilitate high-level qualitative and quantitative research and the development of innovative instructional programs.

Resource Library. The Technology Resource Library would house instructional materials, educational software, and vendor information for educators. The library will feature an indexed collection of educational software and information on instructional technology. The materials will be made accessible both manually and on-line. Resources will also include informative materials on vendor supported technologies. Educators visiting the center will able to preview the materials as well as receive training on its use. Educators will also be allowed to check out the materials so that the can demonstrate them at the collaborating school sites.

Video Production Studio. The TTEC Video Production Studio provides facilities to edit and produce video tapes. The studio also serves as a receiving point and distribution site for video conferencing, distance learning via satellite or microwave, and closed circuit television. Post-production facilities include the capability for non-linear digital editing or video, voice, text and graphics.

Research & Development Lab. The TTEC Research and Development Lab services as a focal point for research projects currently conducted by UHCL faculty and students. The lab provides a synergistic environment where software engineers, instructional technologists, graphic artists, cognitive psychologists and content area specialists work together to build learning environments of tomorrow. The lab contains the hardware and software necessary to truly impact the way we teach and learn via cutting-edge computer technologies.

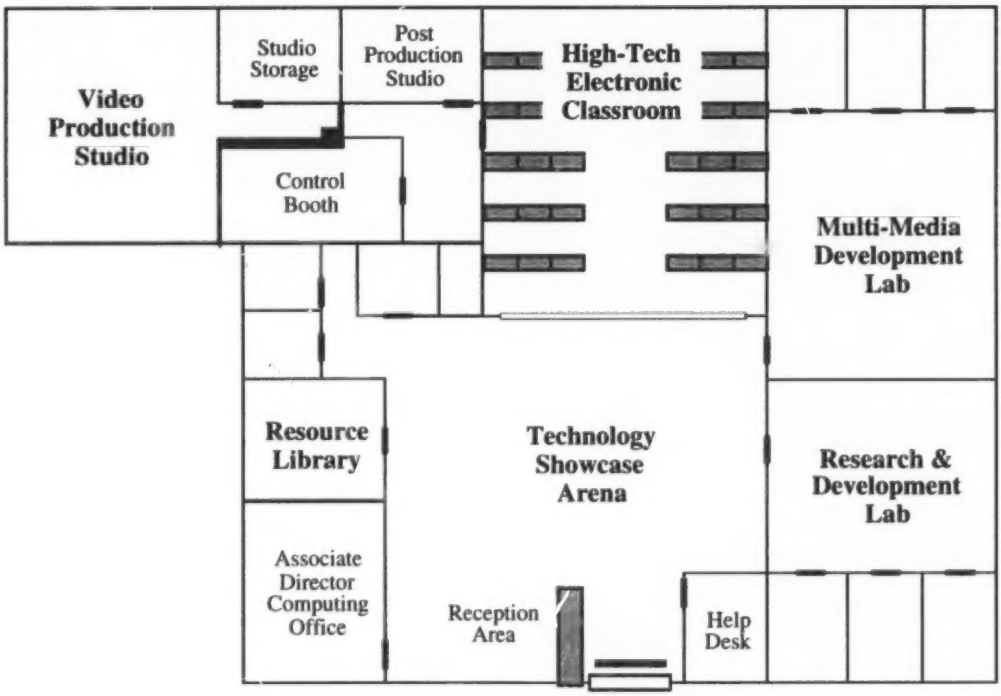

Figure 4. Teacher Technology Exploration Center

Distance Learning Programs

The development and implementation of distance learning programs allow the TEA^{3}M collaborative to optimize its resources. Consistent with the TEA^{3}M's strategy for providing site-based, real-world experiences, distance learning programs will permit university faculty to deliver instruction to teachers and students at the collaborating school without the cost of sending instructors to each site. In-service workshops and seminars provided by the Region IV Education Service Center and by the UHCL Teacher Center may also be delivered to each site by this mechanism.

In addition to providing information and training to TEA^{3}M collaborative members, the development of the distance learning program will allow students and teachers to communicate and share experiences with other students, teachers, and other professionals from all over the world. After the initial program and networking infrastructure have been installed, UHCL and the Education Service Center will work with teachers at each collaborating site to develop their own distance learning programs. These programs will help break down classroom walls and allow students at the collaborating sites to share experiences with students from other regions of the Texas, the United States, and around the world.

Development of the distance learning programs will be a collaborative effort between the Region IV Education Service Center, the collaborating schools, the University of Houston--Clear Lake, and public utility companies. During the first year of the initiative, collaborating schools will be linked to the existing Interact system with a TV antennae, TV monitors, VCRs and telephone lines. One-way video and two-way audio transmission will

permit UHCL, the Region IV Education Service Center, and the UHCL Teacher Center to deliver interactive workshops and courses to ea[illegible]ol site. This system will meet the collaborative's immediate needs as well as prov[illegible]undation for the development of future distance programs. In addition, SouthW[illegible]n Bell and Phonoscopes Inc. are now assisting UHCL assess the availability of netwo[illegible]g resources at the collaborating schools and at the university in preparation.

The long-term plan is to connect public schools, UHCL, and the Region IV Education Service Center with high speed digital networks. Digital networks reduce attenuation, distortion, and noise accumulation common to current analog systems. Digital transmission is also the universal language of data communications, thus, reducing compatibility problems and the expense of converting analog and digital signals. Digital networks allow two-way video, audio, and data transmission between all sites with greater

Currently, the plan is to keep abreast of legislative, university, district, and school decisions regarding technology, monitor technological advances, and continue to develop our own capacity for delivering distance learning programs. As a clearer picture of this technology emerges, we will make much more informed decisions about the purchase and installation of high-end networking systems. Until then, we will train educators in the design, development, implementation, and evaluation of distance learning programs utilizing the existing Interact system as well as any system made available in the TTEC.

Undergraduate and Graduate Courses at UHCL

Pre-service teachers will acquire much of the basic, technology related skills in undergraduate courses at UHCL. Soon, all pre-service teachers participating in the TEA^{3}M collaborative will be required to take a computer literacy course as a pre-requisite to enrollment in the teacher education program. As a part of their teacher education program, they be required to take INST 3133--Classroom Computer Usage. In this course, students will learn how to use personal [illegible]erformance tools, such as word processors, databases, spreadsheets, and communication applications and learn how to locate, evaluate, and integrate computer-based educational programs. Students in this class will also learn how to access and critically examine research studies on computer use in education. In addition, pre-service teachers will learn technology related skills as a part of their respective teaching methods course. In these courses, students learn how to integrate subject-area related computer-based educational program with course curriculum.

The University of Houston--Clear Lake also offers a series of courses and a masters degree in instructional technology. As a NCATE accredited program, the Instructional Technology program at Clear Lake offers quality classes on the use of leading-edge instructional technologies (e.g., Macromind Director, Authorware, and hypermedia), the systematic design of instruction, and needs assessment and strategic planning. All pre-service and in-service teachers involved with the TEA^{3}M collaborative will be urged to take these courses as well as others provided by UHCL.

Workshops and Seminars

To be responsive to the on-going needs of educators at each of the collaborating school sites, workshops and seminars will be given by UHCL, the UHCL Teacher Center, and the Region IV Education Service Center. A survey of educators will be taken on a regular basis to determine what type of workshops and seminars are to be delivered. For example, during this past spring, a survey was distributed to all educators at each of the four collaborating school sites. It was indicated that a significant number of educators would like

some training and information on the use of TENET. These requirements were matched with resources available at UHCL, the UHCL Teacher Center, and the Education Service Center and it was decided that faculty at UHCL will provide a workshop on TENET during the summer. Workshops and seminars will be provided on an as needed basis and will be delivered at the UHCL campus, at the Region IV Education Center, at one of the collaborating school sites, or via the distance learning network.

Site-Based Training and Support

It is anticipated that the integration of technology at each of the collaborating schools will require some site-based training and support. No matter how much instruction is given through courses, workshops, and seminars, there will be some need, particularly during the early stages of this initiative for one-on-one support. The plan is to give pre-service teachers sufficient skills so that they can provide practicing educators with much of the support and training necessary to use technology. However, particularly during the first year of the program, both pre-service and in-service teachers may require training, particularly in the areas of networking and the use of learning management systems. Faculty and staff at UHCL, graduate students in the Instructional Technology program at Clear Lake, and staff at the Region IV Education Service Center will go to each of the collaborating school site and provide training and support on an as needed basis.

Assessment

The function of assessment is to collect data on pre-service and in-service teacher performance. In terms of technology, data will be collected to determine if teachers: (1) acquired the computer technology related skills and knowledge defined by curriculum; and (2) apply these skills and knowledge to facilitate their students and their own performance. Data from assessment will be used as feedback for pre-service and in-service teachers to improve their performance as well as to evaluate the effectiveness and efficiency of the technology system.

For the TEA^{3}M collaborative, pre-service teachers achievement of computer-technology related outcomes will be assessed by a portfolio. For their portfolio, pre-service teachers are expected to provide five different types of products as evidence of their accomplishments. The products include: (1) research, such as a review of literature on the use of particular computer application in education; (2) a video which depicts the teacher implementing computer-technology in an instructional setting; (3) lesson plans which show the inclusion of technology; (4) assessments that demonstrate teachers ability to measure students acquisition and application of computer-technology; and (5) resources, such as a directory of people, software, and hardware products and services. The portfolios are examined by university faculty as well as the TEA^{3}M of teachers who are supervising the pre-service teacher.

Evaluation

The evaluation function monitors both internal programs and external conditions to make necessary revisions to the system. This approach assumes that if teachers and students are not learning, one or more components of the system is not working. Where assessment focused on individuals acquisition and application of specified learning outcomes, evaluation aggregates assessment data and collects additional information to determine the effectiveness and efficiency of the system and system components.

A framework was created to guide the evaluation process. Based on Kaufman's (1983) Organizational Elements Model, the framework cutlines 5 different levels of organizational effort and results that are to be evaluated. The framework also helps define evaluation questions and specific components that are to be evaluated. Figure 5 illustrates the evaluation framework used to guide the evaluation of the TEA^{3}M system for infusing computer technology.

Logistics

Logistics are responsible for all business-related aspects schooling. In terms of technology, this refers directly to the purchase and maintenance of hardware and software. Grants are often written to cover the initial cost of buying and installing computer equipment. However, relatively little thought goes to the institutionalization of hardware and software upgrades and maintenance. Educational innovations, particularly those received from grants, are frequently viewed as add-ons to the current system. Thus, support for certain innovations dissolves as political and economic climates change. Without continued funding, hardware and software soon become obsolete and are left to gather dust in an obscure corner of the classroom.

To address these concerns, the TEAM collaborative works directly with each school's district office. Decisions regarding hardware and software purchases, networking, and maintenance are aligned directly with each districts long-term plan for integrating computer-technology. In this manner, the collaborative ensures that hardware and software brought in through the grant will be compatible with the technologies to be installed at each site by the district over the next five years.

Based on the premise that schools will continue to acquire classroom computers, the TEAM collaborative decided to allocate its technology resources on computer workstations for each teacher's desk. If teachers are expected to develop innovative strategies for increasing students' performance through the use of computer technology, it is believed that they must first feel confident in their ability to use it through its daily application.

	INPUTS	PROCESSES	PRODUCTS	OUTPUTS	OUTCOMES
Evaluation Question	What resources were used for this initiative? Were they cost-effective& sufficeint to meet goals?	How efficient was the process? Were the customers satisfied?	To what extent do learners acquire the desired skills and knowledge?	To what extent do learners apply their newly acquired skills and knowledge?	What impact does these learned capabilities have on student achievement?
Evaluation Components	1. **Human** - Number, Position, Skills, Knowledge, Time, and Attitudes. 2. **Materials** - Type, Cost, and Allocation. 3. **Equipment** - Type, Cost, and Allocation. 4. **Space** - Amount & Location. 5. **Financial** - Total Cost, Cost by Location, Cost by item.	1. Knowledge Network 2. Teacher Technology Exploration Center 3. Distance Learning 4. Undergraduate & Graduate Courses 5. Workshops & Seminars 6. Site-based Training & Support	1. Productivity Tools 2. Telecommunication Tools 3. Learning Tools 4. Management Tools 5. Collaborative Tools	1. Productivity Tools 2. Telecommunication Tools 3. Learning Tools 4. Management Tools 5. Collaborative Tools	1. Placement rate of teachers 2. Students' skills, knowledge, & attitudes @ each grade 3. Students' ability to use personal productivity tools 4. Students' ability to use telecommunication tools 5. Graduation/Dropout Rate 6. At-risk probability 7. Success in next grade level
Evaluation Techniques	1. Hardware & Software Inventories 2. Preservice & Inservice Teacher Surveys. 3. Cost-Benefit Analysis 4. District Technology Plans 5. University Technology Plans 6. State Technology Plans 7. TEAM Budget Reports	1. Customer Satisfaction Surveys 2. Workshop Evaluations 3. Student Course Evaluations	1. Course Exams 2. ExCet Exams. 3. Preservice Teacher Portfolios 4. Inservice Teacher Class Products 5. Workshop Products	1. Preservice Teacher Portfolios 2. Preservice Teacher Journal 3. Classroom Observations 4. Inservice Teacher Class Products 5. Administrator Questionnaires 6. Piems Data	1. TAAS Scores 2. NAPT - Norm referenced tests 2. Placement Data. 3. Classroom Observations 4. Student Grades 5. At-risk probability instrument 6. Student Surveys

Figure 5. TEA^{3}M Evaluation Framework

Each public school received twenty teacher workstations (one per teacher working directly with the TEAM collaborative) and a multimedia presentation system. One school choose IBM and another IBM compatibles because the district would support only those platforms. The third school choose Macintoshes because they felt that it would be easier for their students and teachers to learn. The IBM and IBM compatible teacher workstations included a 33Mhz 486DX processor, 4-8MB of RAM, 120-240MB hard drives with DOS and Windows pre-installed, SVGA monitors, mouse, keyboard, and 10baseT transceivers. Centris 610 with CD ROM, 8MB of RAM and 240MB hard drives and Duo Docks with PowerBook Duo 210 with 4MB of RAM and 80MB hard drives were purchased for the Macintosh school. Each multimedia presentation system included a high powered CPU, color scanner, a CD and a laser disc player, a LCD projection panel, and an overhead projector.

By working with each district office, the collaborative was also able to leverage resources to install the local area networks. In most cases, plans were already in place for cabling the entire school within the next two to three years. By pooling the resources, the collaborative was able to get the district to install the cabling required to network the teacher workstations by the end of this school year. The public schools will retain the computer equipment as long as they remain active participants of the collaborative (e.g., provide internships for TEAM pre-service teachers) and the districts assume responsibility for maintenance and upgrades.

Management Operations

Management operations is charged with making decisions regarding organizational

policies and procedures, resource allocation, and program design and implementation. In education, researchers and administrators distant from daily classroom practices, initiate and manage numerous grant-related programs. Few top-down strategies, however, have had a significant impact on classroom instruction because they fail to account for the pragmatics of daily school routine. Scorned by teachers who have been asked repeatedly to implement new programs with little time or training, top-down interventions are not owned by the practitioners and thus, are not frequently implemented as planned.

New programs designed by site-based committees have also seen limited success. In contrast to top-down strategies, "bottom-up" initiatives are constrained by the lack of time and training for program design. As advances in technology continue to increase, even the most avid technologists are hard pressed to keep up with the latest changes. Practitioners responsible for educating 20-40 students on a daily basis can not be expected to continuously acquire the skills necessary to apply leading-edge technologies without additional resources.

To address the limitations inherent to top-down and bottom-up interventions, TEAM employs a collaborative consensus process to guide system design and implementation. In this process, representatives from all system stakeholders participate in programmatic decision-making.

Five committees manage the computer-technology system for the TEAM collaborative, including: (1) three site committees, made up of the principal, the site coordinator, the school computer lab coordinator, and the district technology coordinator for each school; (2) a university committee, consisting of three representatives from the University Computing department and three faculty members from the Instructional Technology program; and (3) a collaborative-wide technology committee, comprised of all members of the public school and university committees. In addition, a Director of Technology for the TEAM collaborative is charged with coordinating the activities of the various committees as well as integrating technology with other aspects of the TEAM's teacher education program.

The site-based committees are responsible for making decisions that affect resource allocations and program implementation at each school. For instance, each public school committee determined the type of computers that were to be provided by the collaborative. The university committee, in comparison, choose the hardware and software used to network the schools to the university and created the Teacher Technology Exploration Center. The collaborative-wide committee set policies for allocating grant-related funds and specify the software to be purchased and supported by the collaborative.

Professional Development

The function of professional development is to train and support staff in implementing the TEAM system for infusing computer technology. The products of professional development are educational experiences and staff support services. Initially, focus is being placed on developing each site's capacity to manage their own local area network and utilize the computer applications provided by the collaborative. The strategy is to develop a core of technology proficient educators who can trouble shoot basic problems and serve as a resource for students, teachers, and administrators at each site.

Educational experiences range from specific training sessions provided by computer vendors on the use of their equipment, to more general types of experiences such as attending computer conferences. The goal is to provide a wide range of opportunities that will enable educators to pursue their own areas of interest. In this manner, educators will gain expertise in different areas of computer use at each collaborating school site and will be able to provide information and support to other educators at their school on a timely basis.

Particular attention is also being placed on establishing a collaborative-wide human performance support system. The support network identifies individuals from the university, public schools, computer vendors and other businesses both within and outside of the collaborative who have expertise in particular areas of computer use such as networking, desktop publishing, distance learning, and multimedia development. A list of experts, including their e-mail address and phone number, is kept up-to-date and disseminated to all members of the collaborative.

Summary

The TEA^{3}M collaborative is currently in its first year of development. The goals for technology during this year are to: (1) analyze the computer-technology requirements at each collaborating site; (2) install computer workstations, local area networks, and the wide area network which links the public schools to the University, TENET, and Internet; (3) purchase and install basic computer applications (e.g., productivity & telecommunication tools); (4) define a computer-technology curriculum for both pre-service and in-service teachers; and (5) begin the design and delivery of instruction. To date, the technology requirements at each collaborating site have been assessed, curriculum and instruction are being designed, and the computer workstations have been purchased and installed. By this summer, the local area networks, the collaborative-wide network, and the Teacher Technology Exploration Center should be fully functional. By year two, we hope to see a significant number of pre-service and in-service teachers who are able to increase student and their own performance through the infusion of computer-technology.

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